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pied by the older Miocene, is usurped by a long synclinal valley, which is overwhelmed by deep sands. Upon the maps this syncline is easily followed by Sandy Creek and the upper waters of Shoal River. From the bend of the latter the syncline crosses to the Yellow River and takes the whole valley of Black-water north of Otaheite.

The great roll, or anticline, forming the southern and western limits of this syncline, may be easily followed westward from Alum Bluff, by Abes Spring — crossing Choctawhatchee at Knox Hill — and forms the high ridge upon which Defuniak is located. It is cut through by Shoal River at the high hills or bluffs between the Wise Bridge and Christmas Bluff, and by Yellow River at Hickman Bluff, above the railroad, and subsiding below the same southward to Daw's Bluff and northward to Oak Grove, whence fifteen or twenty miles of the river is in the trough of the syncline, the very region where the older Miocene should be found, if continued west of Econfinia River.

Walton County, West Florida, is traversed by some considerable streams, which have removed in places the superficial Orange Sands, and cut deep into fossiliferous beds, on Yellow River, Shoal River (lower part), Alaquá, and Blairs Creek or Euchee.

Christmas Bluff — an almost inaccessible locality in the vicinity of Taylor's Mill, to the north of Mossy Head, is perhaps the best for the amount of the exposure — there being sixty feet from the water to the Orange Sand of the ridge above — twenty feet of the top being calcareous and full of the finest shells. The lower forty feet of the bluff seem to be without fossils, at least none were discovered at the brief visit of 1889. The compact sands of this lower part of the bluff strongly resembled those at the base of Silas Bluff on Conecuh River, and still more the sands at the head of Ten-mile Creek, and on Econfinia in Calhoun County, Fla. In the last, however, were impressions of fossils, which connected it with the Chattahoochee Formation.

At no one of the many localities exposing fossils could all the phases of these formations be seen. Alum Bluff comes the nearest to this requirement; yet it is best to study them where more widely parted and where each may have scope for a grander display.

Such typical localities may be found on the two neighboring creeks, Alaquá and Euchee, south of and very near to Defuniak Springs.

The phase seen near Euchee Ana consists of a sandy ferruginous clay, calcareous in spots, having innumerable shells and casts of the small *Mastra congesta*, mixed with or finished off at the top with a good deal of silicified wood and lignitic matter. This is the counterpart of the topmost layers at Alum Bluff and of the lowest bluff at Abes Spring on Chipola.

The Alaquá phase, on the other hand, has the larger shells — *Conchs Cardiums*, *Arcas*, *Pectunculus*, etc., in good variety, and a fine state of preservation. This is the formation of the upper bluffs at Abes Spring. In fact, Chipola River affords the finest opportunity for the study of all the phases of the Miocene with exception perhaps of the Wakulla rocks. There is at the Abes Spring lowest bluff more than 100 feet longitudinally of the Euchee phase, above that more than a mile of the Alaquá phase, culminating in a 60-foot bluff at the Darling Slide, and above that for eight miles are the Red Ortholax beds, and gray allied calcareous sands up to "Look and Trimble" shoals of the more indurated Chattahoochee form.

The Alaquá phase the writer learned from Mr. N. H. Darton, whom he met in Florida soon after the discovery, to regard as equivalent to his Chesapeake. The more complete studies of Dr. W. H. Dall, it appears, led him later to the same conclusion.

The younger Miocene, of the Alaquá type at least, is perfectly and largely developed on the bluffs of Yellow River, from the Alabama line to Milligen in Florida, the most northern of these beds being the low shell landing at Oak Grove, six miles south of the line.

Twenty miles north-west of Oak Grove, and across the deep sands of the synclinal valley of Black Water, the great anticlinal roll reaches Conecuh River. At Roberts, on the head of Silas Creek, the bluff washed out by the waste-way of the mill is filled

with casts of the same Alaquá fossils. The clay and wood and lignitic matter of the upper part of this wash-out bluff seem identical with Coal Bluff, six miles to the south-west. No fossils are found at the Silas Bluff, though so near; and there is no reason to doubt that the lower strata of Silas are identical with the outcrop at Dixon's Chalk Hill, six miles further north, and 100 feet higher hypsometrically, — that is the same as the older underlying Grand Gulf quartzitic clays and rocks, — neither should it be doubted that these are equivalent to the calcareous clays of the Chattahoochee formation — in time. That these in precise mode and form did not pass this far west is in perfect harmony and accord with the geological history of the region.

III. In time of the older Miocene, all of Florida above water was an archipelago of small Eocene islands, located where now are the counties Suwannee, Fayette, Columbia, Alachua, Levy, Marion, Hernando, Citrus, Pasco, and Sumter, — or rather parts of them, — and there were probably a comparatively deep strait and strong current between them and the Eocene rocks of the same age in Georgia. Dr. Dall has shown by the fossils that this channel of the older Miocene period was a warm-water sea.

In this warm-water channel was laid the Wakulla rocks of the county of that name, of Jefferson, of Leon, and of Jackson, underlying the Chattahoochee beds.

Now observe upon a map how the Eocene of Jackson and Holmes extends southward to Orange Hill in Washington County, which rises boldly above the waters of the low country a height of some 200 feet. In Miocene time this must have been a notable promontory, jutting out into the shallow seas. It is not probable that the warm currents of the great bight of Georgia, either at ebb or flow, had much force to the westward of Orange Cape, and the cold waters of the Mississippi embayment, as reasoned by the same authority, reinforced by the rivers of Alabama, creeping along through estuaries, were very unfavorable to molluscan life. For which reasons, when by position and continuity, the rocks of Wakulla and of Chattahoochee shall have been traced westward of Orange Hill, it is not to be expected the fossils of *Weelaumee* and of the Red-beds will be found therein.

There remain now only two other formations, not collated and accounted for — the Pascagoula clays and the Euchee phase of the younger Miocene.

So far as known, the Euchee stops abruptly at Daw's Bluff below Milligen. This part of Santa Rosa County is depressed, whether by subsidence or by denudation does not as yet appear. By position it might be assumed that the Euchee is to the east the equivalent of the Pascagoula of the west. But the fossils are not the same; neither is it probable that the circumstances of genesis were the same in both. Proximity to the Great River rendered the laying down of every phase of the Grand Gulf unique on this continent.

Both the Pascagoula and the Euchee were estuary so far as they agree, and it is possible the small *Mastras* to the east were the representatives of the still less marine *Guathodons* of the west. It is said the living *Guathodon cyrenoides* of our coast is not at present found east of Mobile Bay, but the writer has found them in Kitchen-middens on Choctawhatchee Bay, in the waters of which they and the oysters are now both said to be wanting. If not exactly equivalent, both these stand in the several regions to which they belong as the youngest known formations of this Miocene group.

#### THE SCIENTIFIC ASPECT OF THE UNIVERSITY SETTLEMENT MOVEMENT.

BY FREDERIC A. C. PERRINE, D.S.C., BOSTON, MASS.

OF the social work in our great cities by philanthropists and churchmen, there is undoubtedly a considerable proportion unfortunately carried on in such a casual manner as to afford only pain to one trained in habits of scientific investigation and scientific caution in action. Many charitably-aimed movements have been proven to be the greatest practical failures and, in spite of the high-minded intentions of their progenitors, stand con-

demned at that highest of courts which demands fruits for judgment.

It must, therefore, be a relief to the minds of those having a knowledge of the need for social effort and at the same time a conception of the value of true scientific methods in such effort to know that there is at present being developed a movement having for its principle aim the general solution of the problems attacked in the light of a scientific study of the conditions and the elements actually involved in the various problems as presented in the lives of our municipal communities.

This movement to which we refer, the University Settlement effort, came originally from Oxford and was the practical suggestion of Arnold Toynbee, for whom the great settlement of London has been named and from whom came the inspiration of the workers in this and other countries.

To solve the problem of heat and light or electricity while being shut out from a possible knowledge of the facts involved or a possibility of experimenting with those forces we would to-day consider to be the height of intellectual absurdity and worthy only of the *a priori* philosophers of the Middle Ages, whose opinions are of value only as curiosities.

Or once having exactly ascertained the existence and the laws of physical phenomena and not to attempt to make use of our knowledge for the practical advancement of life upon the globe and for progress in the arts we are bound to regard as lack of enterprise and the spirit of ultimate scientific progress.

But in the so called "Social Sciences" and their application we are only gradually adopting the inductive method for gaining knowledge and have been devoting more time to the attempted ultimate solution of fundamental problems on insufficient premises than to the practical application of such knowledge as we have already gained and the actual face to face study of the conditions for the discovery of future data.

With the sense of this lack of scientific method in the study of our social questions and the feeling of urgency in the necessity for the application of such truths as we have already obtained, the men and women of the University Settlements have established, in several of our great cities, houses, to be centres for work, set down in the midst of the conditions which are to be investigated and acted upon.

While many of the people who have taken up this work are undoubtedly so directed from their affiliation with the Church and its efforts for regeneration, the methods used are essentially foreign to what has been known as "Church work," and their aim is very far from being along the lines of attacking the problems which are purely physical from the spiritual standpoint. But striking out along the grand lines of the early development of altruism from egoism though the fellow feeling for those with whom we are in personal contact, they have adopted the idea of the self-help of a neighborhood as their governing principle. With this moving principle in view the University Settlement movement is easily understood.

Primarily it is, by bringing to the view of what has been called the "submerged tenth" the lives of those successful in the battle for contentment in life through higher ideals and greater education, to create a feeling of dissatisfaction with surroundings not typifying those ideals and to open to their minds the possibility of progress through advancement in knowledge and the attitude of mind which is not content with the creature means of existence, and, as neighbors, to help all such as have already gained a desire to become more worthy citizens, men and women. As a means for such influence the work of the settlement in visiting, clubs, classes, and all kindly actions is instituted.

For those beyond the possibility of these influence, and even beyond the effect of any efforts made for social regeneration, the situation in the midst of such classes offers a possibility for the study of the conditions and the internal life and movement of the subjects to be acted upon. Studies have begun in the collection of facts and phenomena which gradually but only gradually develop the laws of social dynamics and social statics which have been so often approached from the theoretical but so seldom from the standpoint of induction and experiment.

As the facts are discovered and these laws developed the per-

sonal relations of the workers in such fields must yield to their minds the true methods of attacking and solving the problems which perhaps only first in these studies have been presented and enable them to point out to individual workers as well as to municipalities the directions of sure progress.

Not by any means the least productive effort of the settlement is this unification of the direction of the efforts which various social workers have been making towards a greater advance in economic progress and the bringing of the various classes of the community into harmony with each other.

There is no one that will doubt that a common humanity actuates us all, but it is at the same time impossible to say that there is a comprehension of this fact in the minds of the individuals belonging to the several classes.

While our origin and essential characteristics may be identical, it is nevertheless true that the variations in the external conditions have so far led us to apparent hostility that the fact that there is a common point of interest has become almost completely extinguished.

Here lies the dangerous element in the growing movement towards the usurpation of the rights of the individual by the community, for on both sides there always remains a fear of oppression and of usurpation of power by the other. To counteract such a dangerous principle, in either its idea or its application, it has become more and more necessary that our heterogeneous communities should come to a knowledge of their essentially homogeneous character, a knowledge which must rest upon firmer foundations than the mere intellectual conception of a truth and be guarded in a trust across the social barriers, only to be gained by a more intimate knowledge of each other's characteristics as well as each other's conditions of life.

By the studies we are describing the knowledge necessary is gradually being obtained, and the trust accorded by both sides to these students renders possible an actual contact from one side to the other and brings about a trust in the hearts and characteristics of men separated by the wide gulfs of circumstance. Studies such as these are developing, too, the manner of education needed for the most rapid advancement of the community, settling many disputed questions of the bearings on the lives of the people of manual training, day-nurseries, model tenements, boys' clubs, and other similar efforts which have been made from above downward, based on theories founded too often on insufficient knowledge of the facts involved and carried along with too little regard for the actual results attained.

We may, in consequence, expect from this movement a fruit of knowledge gained of social conditions and the results of sociological experiments which, while being of the character of the ascertainment of scientific facts obtained through a scientific method of investigation, yet carries with it practical results in the advancement of the life of the community toward a more rational fitness to the environment and a healthy improvement in the material conditions and culture of great masses of the community.

#### A NEW VISUAL ILLUSION.

BY EDMUND C. SANFORD, CLARK UNIVERSITY, WORCESTER, MASS.

THE following illusion is, so far as I know, new and seems of sufficient interest to put on record. A short-pointed star of white card-board, or even a square, is placed on the spindle of a rotation color-mixer and set in rapid rotation. The resulting appearance is a white central circle surrounded by a transparent ring — most transparent at the outer edge, least transparent toward the centre. If now a piece of black card-board of a length somewhat greater than the diameter of the star from point to point be brought behind it while in rotation, the advance of the edge of the card can be followed, not only behind the transparent ring, *but also behind the opaque central circle*. It is most noticeable just within the circumference of the central circle, and is most marked when the black card is kept in motion. When the card remains stationary, the illusion weakens; and for perfectly stationary objects, like the parts of the rotation apparatus itself, it fails altogether. The portion of the central circle, through which the card seems to be